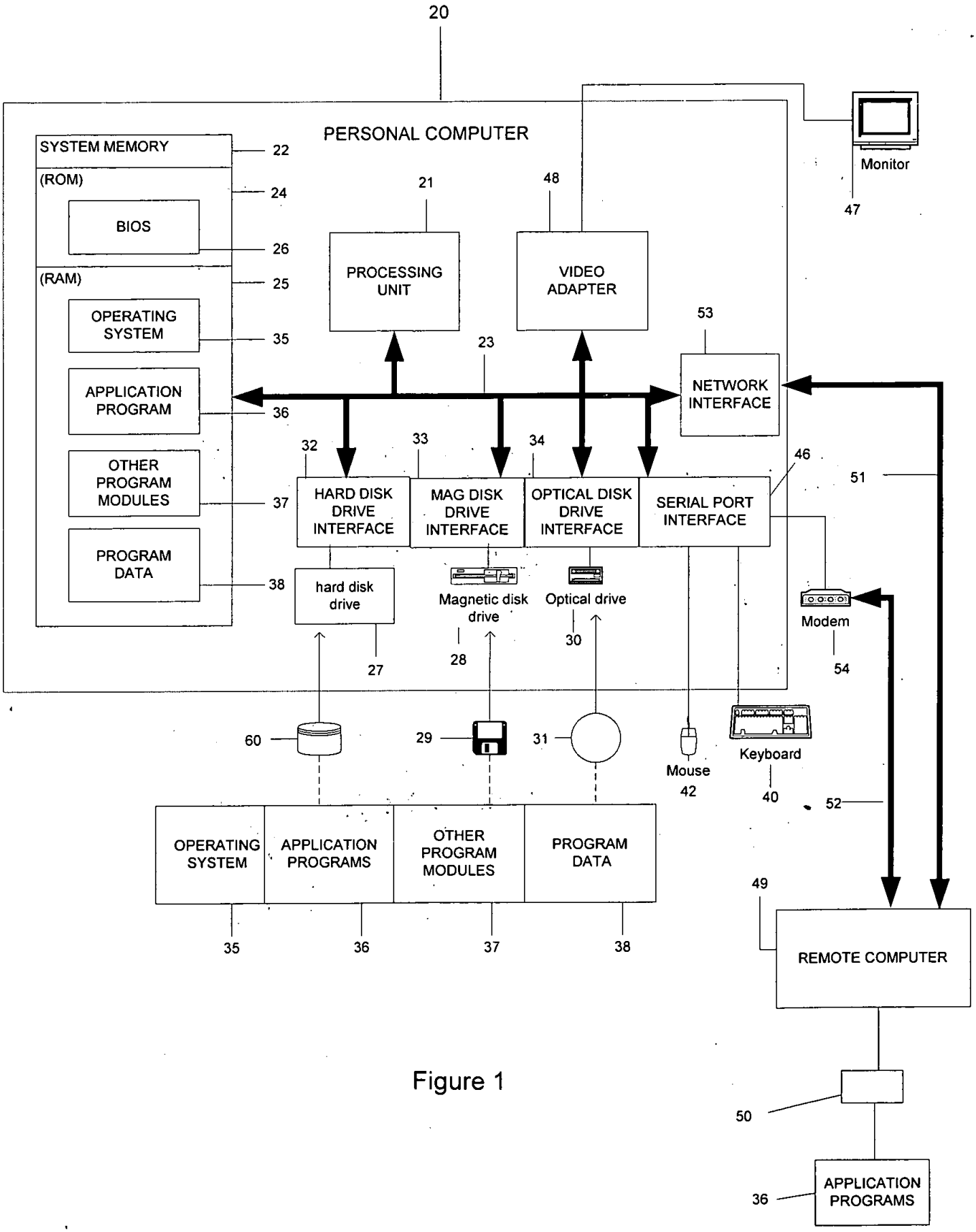
20
PERSONAL COMPUTER
SYSTEM MEMORY
22
(ROM)
24
BIOS
26
(RAM)
25
OPERATING SYSTEM
35
APPLICATION PROGRAM
36
OTHER PROGRAM MODULES
37
PROGRAM DATA
38
21
PROCESSING UNIT
48
VIDEO ADAPTER
Monitor
47
53
NETWORK INTERFACE
23
32
33
34
46
51
HARD DISK DRIVE INTERFACE
MAG DISK DRIVE INTERFACE
OPTICAL DISK DRIVE INTERFACE
SERIAL PORT INTERFACE
hard disk drive
27
Magnetic disk drive
28
Optical drive
30
Modem
54
60
29
31
Mouse
42
Keyboard
40
52
OPERATING SYSTEM
APPLICATION PROGRAMS
OTHER PROGRAM MODULES
PROGRAM DATA
35
36
37
38
49
REMOTE COMPUTER
50
APPLICATION PROGRAMS
36

Figure 1

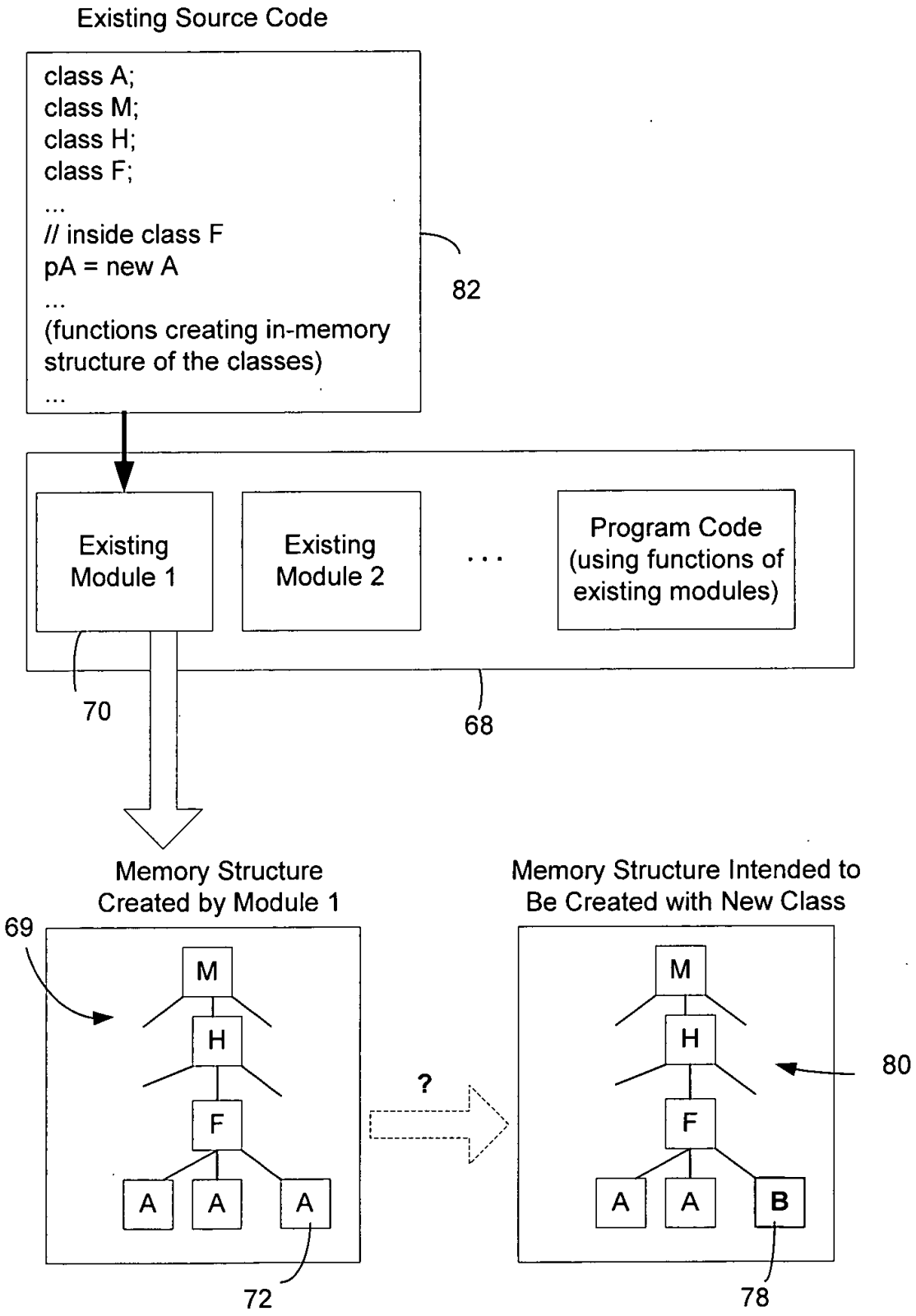

FIG. 2 (Prior Art)

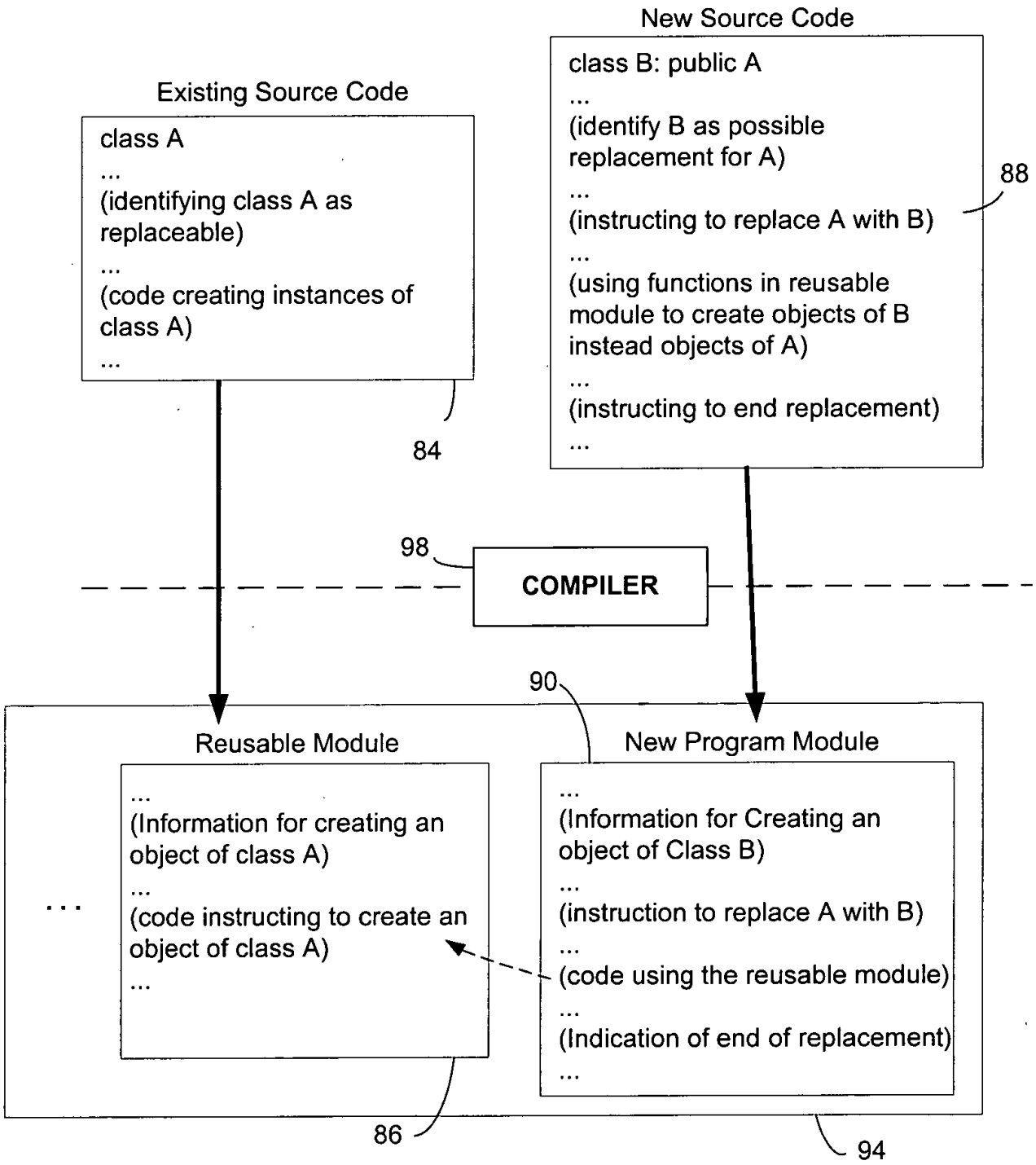
New Source Code
class B: public A
...
(identify B as possible replacement for A)
...
(instructing to replace A with B)
...
(using functions in reusable module to create objects of B instead objects of A)
...
(instructing to end replacement)
...
88
Existing Source Code
class A
...
(identifying class A as replaceable)
...
(code creating instances of class A)
...
84
98
COMPILER
90
Reusable Module
...
(Information for creating an object of class A)
...
(code instructing to create an object of class A)
...
New Program Module
...
(Information for Creating an object of Class B)
...
(instruction to replace A with B)
...
(code using the reusable module)
...
(Indication of end of replacement)
...
86
94

FIG. 3

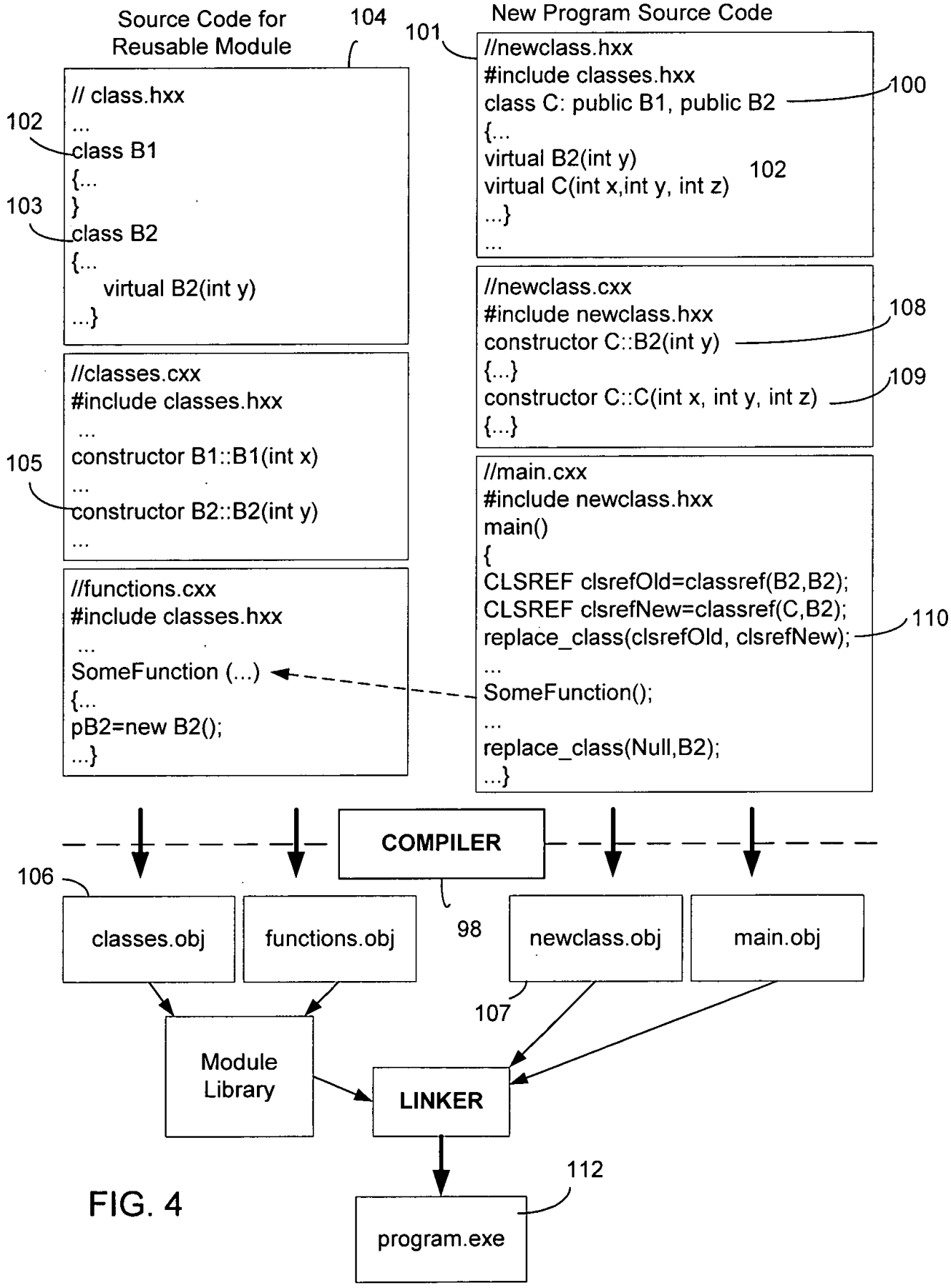
Source Code for Reusable Module
104
// class.hxx
...
102
class B1
{...
}
103
class B2
{...
virtual B2(int y)
...}
//classes.cxx
#include classes.hxx
...
105
constructor B1::B1(int x)
...
constructor B2::B2(int y)
...
//functions.cxx
#include classes.hxx
...
SomeFunction (...)
{...
pB2=new B2();
...}
New Program Source Code
101
//newclass.hxx
#include classes.hxx
class C: public B1, public B2
100
{...
virtual B2(int y)
virtual C(int x,int y, int z)
102
...}
...
//newclass.cxx
#include newclass.hxx
108
constructor C::B2(int y)
{...}
109
constructor C::C(int x, int y, int z)
{...}
//main.cxx
#include newclass.hxx
main()
{
CLSREF clsrefOld=classref(B2,B2);
CLSREF clsrefNew=classref(C,B2);
110
replace_class(clsrefOld, clsrefNew);
...
SomeFunction();
...
replace_class(Null,B2);
...}
COMPILER
106
classes.obj
functions.obj
98
newclass.obj
main.obj
107
Module Library
LINKER
112
program.exe

FIG. 4

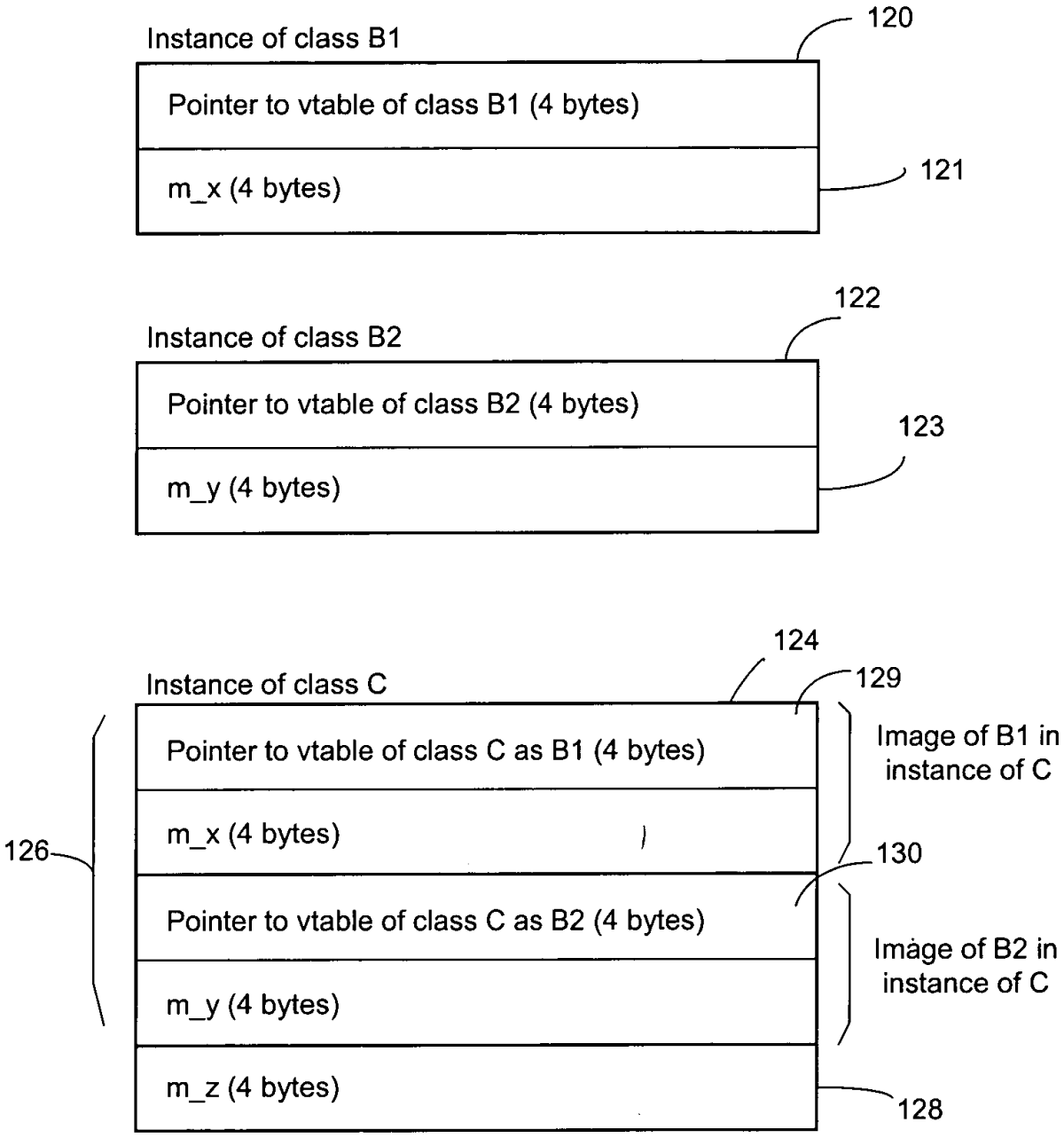
Instance of class B1
120
Pointer to vtable of class B1 (4 bytes)
m_x (4 bytes)
121
Instance of class B2
122
Pointer to vtable of class B2 (4 bytes)
m_y (4 bytes)
123
Instance of class C
124
129
Pointer to vtable of class C as B1 (4 bytes)
m_x (4 bytes)
126
Image of B1 in instance of C
130
Pointer to vtable of class C as B2 (4 bytes)
m_y (4 bytes)
Image of B2 in instance of C
m_z (4 bytes)
128

FIG. 5

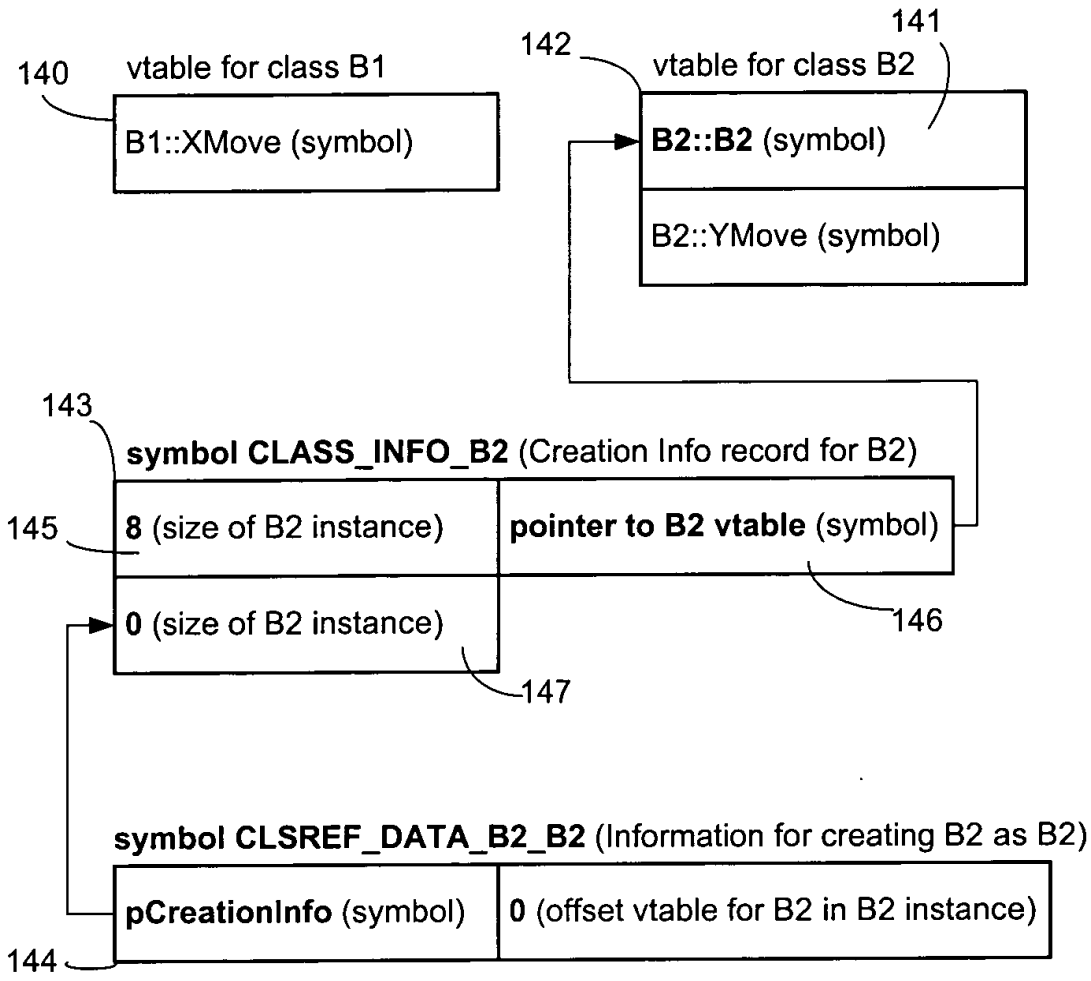
140
vtable for class B1
B1::XMove (symbol)
142
141
vtable for class B2
B2::B2 (symbol)
B2::YMove (symbol)
143
symbol CLASS_INFO_B2 (Creation Info record for B2)
145
8 (size of B2 instance)
pointer to B2 vtable (symbol)
146
0 (size of B2 instance)
147
symbol CLSREF_DATA_B2_B2 (Information for creating B2 as B2)
pCreationInfo (symbol)
0 (offset vtable for B2 in B2 instance)
144

FIG. 6

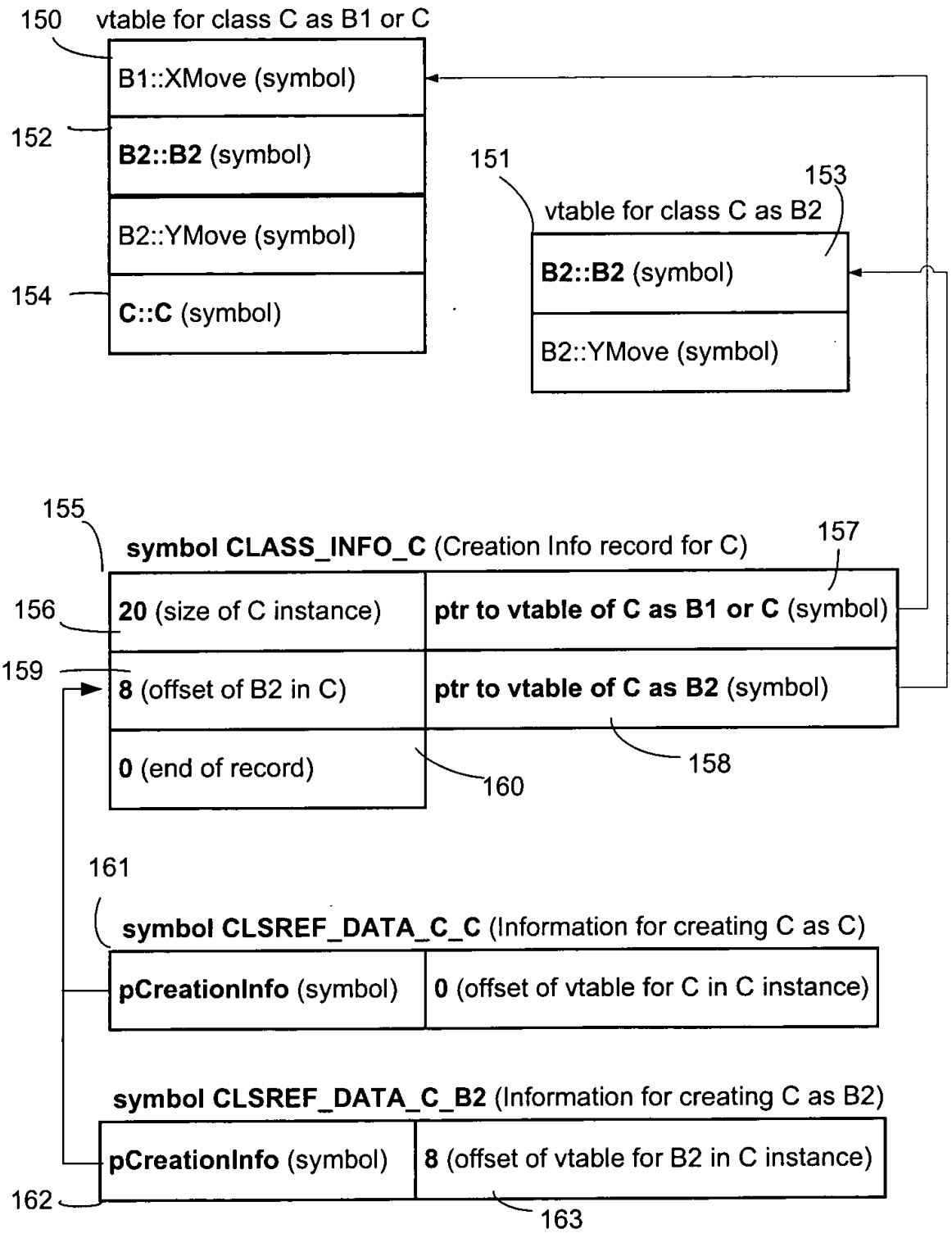
150
vtable for class C as B1 or C
B1::XMove (symbol)
152
B2::B2 (symbol)
B2::YMove (symbol)
154
C::C (symbol)
151
153
vtable for class C as B2
B2::B2 (symbol)
B2::YMove (symbol)
155
symbol CLASS_INFO_C (Creation Info record for C)
157
156
20 (size of C instance)
ptr to vtable of C as B1 or C (symbol)
159
8 (offset of B2 in C)
ptr to vtable of C as B2 (symbol)
0 (end of record)
160
158
161
symbol CLSREF_DATA_C_C (Information for creating C as C)
pCreationInfo (symbol)
0 (offset of vtable for C in C instance)
symbol CLSREF_DATA_C_B2 (Information for creating C as B2)
pCreationInfo (symbol)
8 (offset of vtable for B2 in C instance)
162
163

FIG. 7

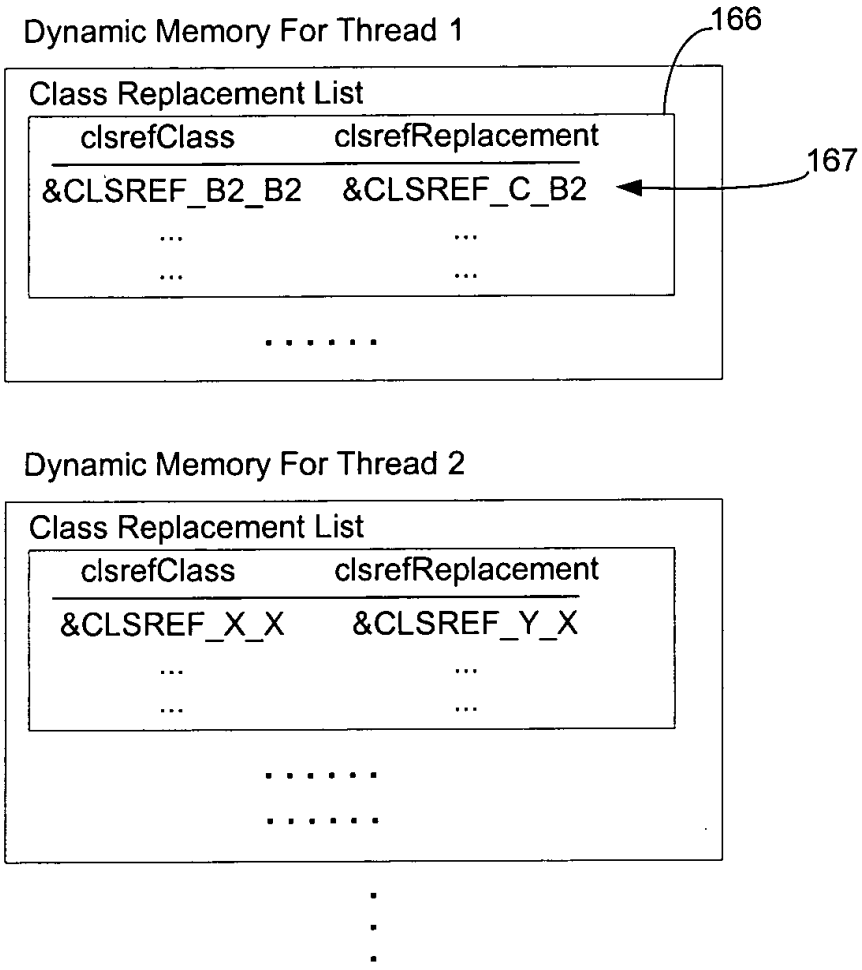
Dynamic Memory For Thread 1
166
Class Replacement List
clsrefClass
clsrefReplacement
&CLSREF_B2_B2
&CLSREF_C_B2
167
Dynamic Memory For Thread 2
Class Replacement List
clsrefClass
clsrefReplacement
&CLSREF_X_X
&CLSREF_Y_X

FIG. 8